Somerville Climate Forward

Greenhouse gas emissions in-depth meeting
August 16, 2017

Outline

- Somerville Climate Forward background
- What are greenhouse gasses? What is carbon neutrality?
- Greenhouse gas inventory highlights
- Emissions pathways analysis
    - Electricity
    - Buildings
    - Waste
    - Transportation
- Core strategies
- What's next

Somerville Climate Forward Vision

Somerville is a **thriving**, **equitable**, **carbon neutral**, and **resilient** city that is preparing for climate change while doing its share to prevent it.

Thriving – Somerville continues to be an exceptional place to live, work, play, and raise a family.

Equitable – The benefits and opportunities created by climate action are fairly distributed to all and resources are prioritized to alleviate the unequal burdens of climate change.

Carbon Neutral – Somerville will have a net-zero release of greenhouse gases. Any emissions that cannot be fully eliminated will be offset.

Resilient – Somerville will adapt in order to be prepared for the chronic and acute impacts of climate change.

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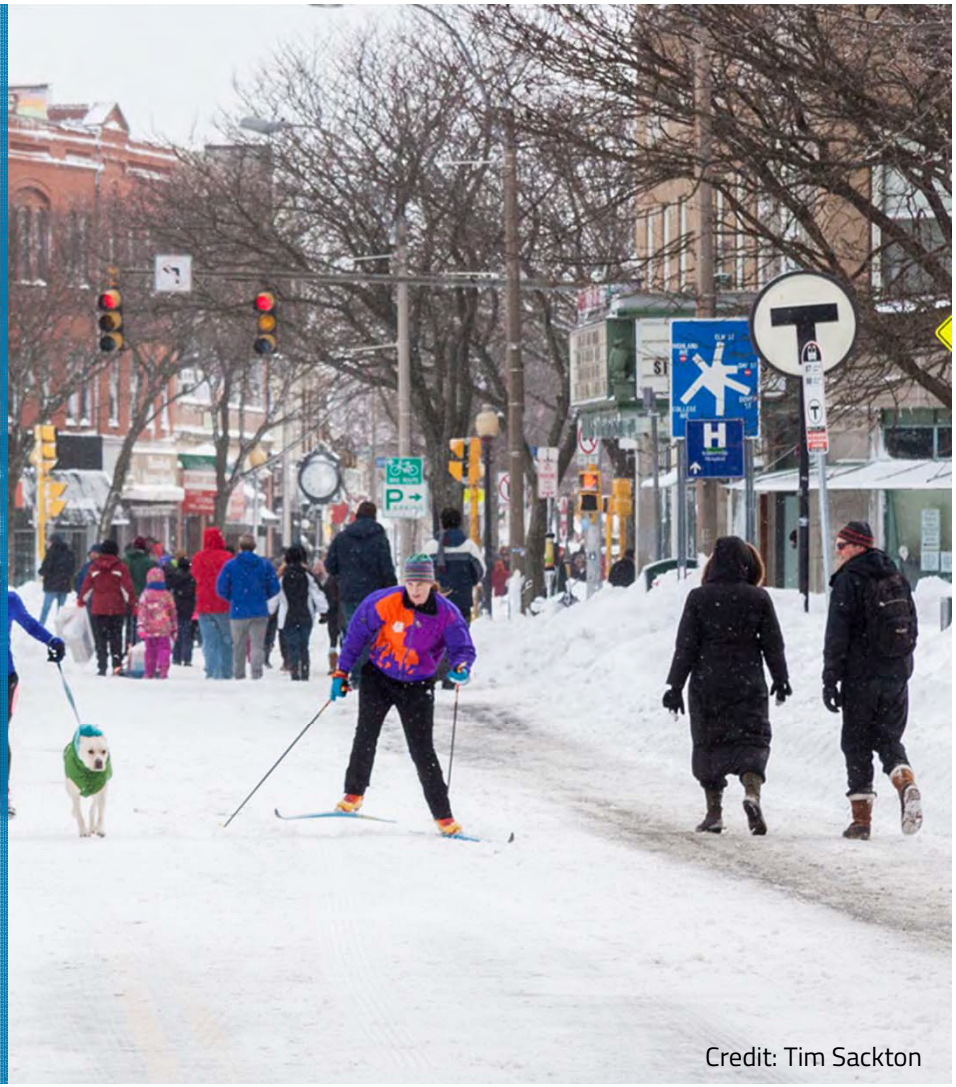
Climate change baseline

- What are our current conditions?
- What might happen in the future?

- Greenhouse Gas Inventories
- Carbon Neutrality Pathway Assessment
- Climate Change Vulnerability Assessment

- Analytical basis for developing strategies



Credit: Tim Sackton

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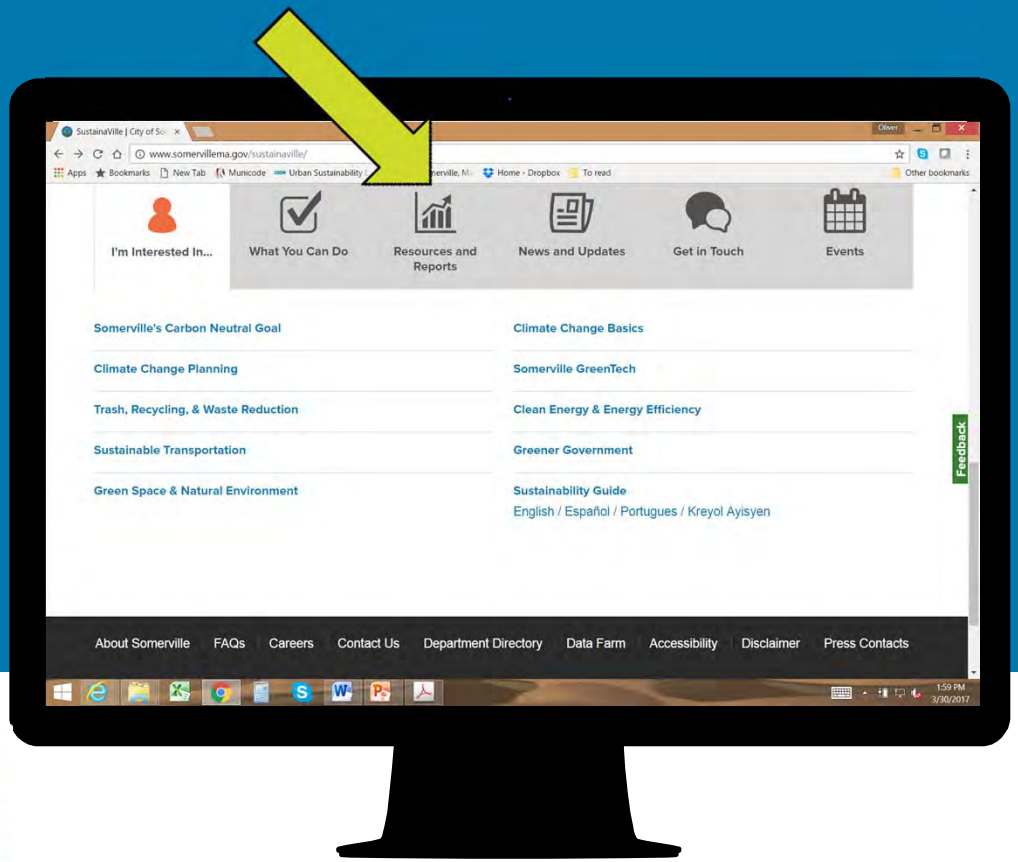
www.somervillema.gov/sustainaville

Online portal for

- Taking action
- Learning about City activities
- Getting involved
- Downloading reports and resources



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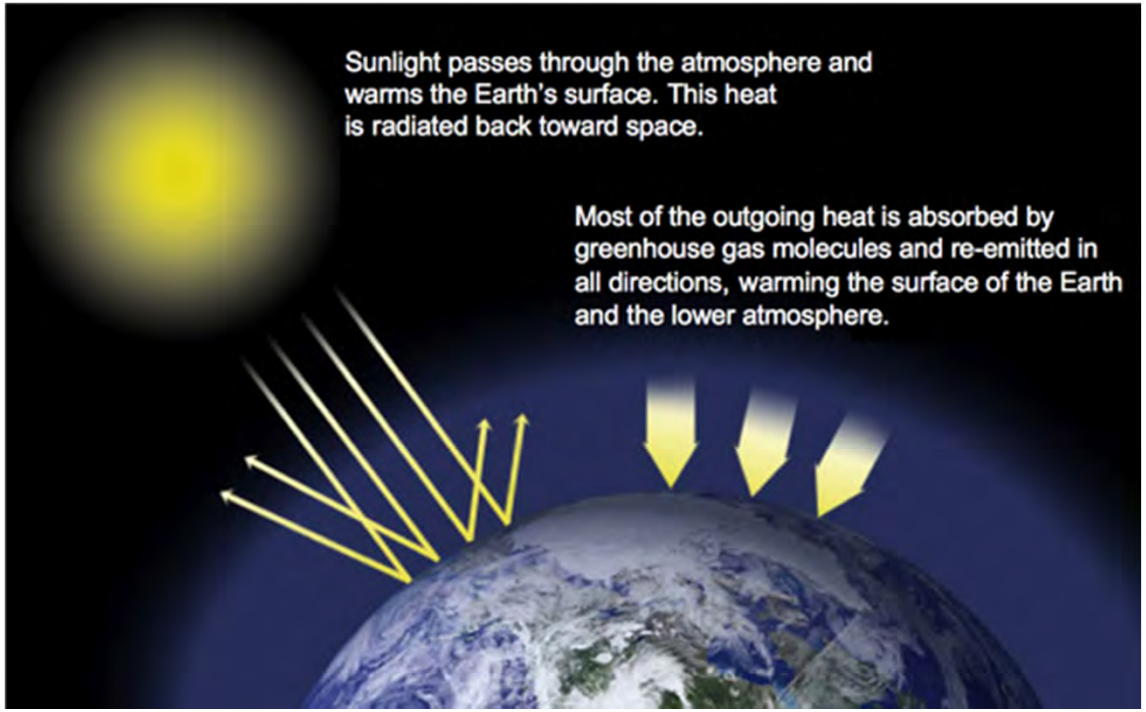
What are greenhouse gasses?



https://climate.nasa.gov/causes/

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Carbon neutral by 2050

- Mayor Joe Curtatone made commitment in 2014
- Joined Compact of Mayors in 2015 (now Global Covenant)
- Led adoption of 14-city metro-Boston net zero region in 2016
- 70% of global emissions come from cities
- Science-based, global consensus
- Strong community support
- Set goal first, then plan

The "Deadline 2020" report recently released by C40 Cities states that **to remain within 1.5°C temperature rise**, average per capita emissions across cities need to drop from over 5 MT CO_2e per capita today to around **2.9 MT CO_2e per capita by 2030 and near zero MT CO_2e per capita by 2050**.

CNCA

PARIS2015 UN CLIMATE CHANGE CONFERENCE COP21·CMP11

GLOBAL COVENANT *of* MAYORS *for* CLIMATE & ENERGY

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Definition of “carbon neutrality”

- Net-zero carbon emission target by 2050
- Some sources of carbon emissions cannot feasibly be eliminated: would require offsets that include either a) biological carbon sequestration, b) exported renewable electricity generation, or c) purchase of carbon credits.
- Target would be similar to the target used by the Cities of Seattle, Melbourne, and Copenhagen.
- Meets reductions called for in the Paris Agreement (maintaining global average temperature increases below 1.5° C)
- Would provide opportunities for regional (Boston metro) collaboration developing offsets.

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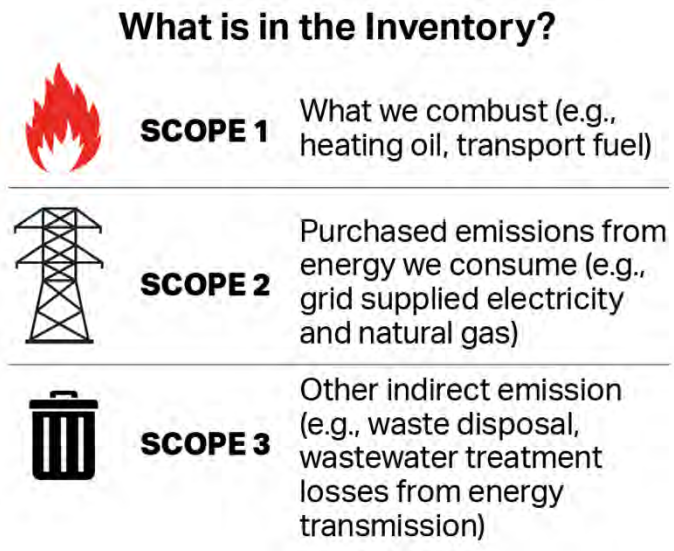
Greenhouse gas inventory

- Follow global reporting protocol
- Based on 2014 data
- Community and City government operations inventories
- Identify sources of our contributions to climate change
- Track progress on emissions reductions
- Updated every two years (2016 is now in progress)



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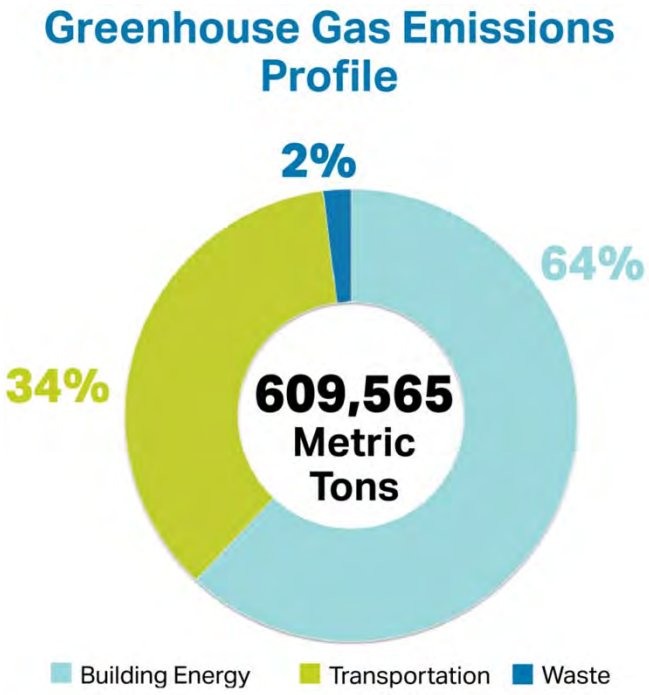
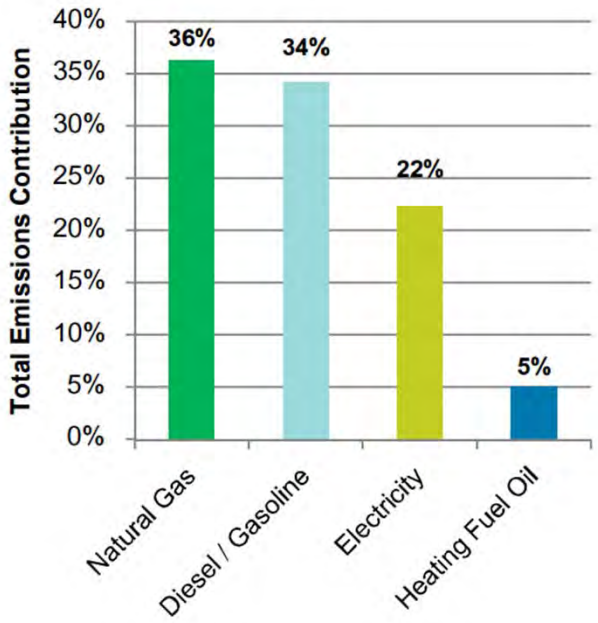
Community Emissions





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What does that mean?

Absorbing GHG Emissions

A forest 185 times larger than the City of Somerville would be required to sequester the total community emissions for one year!

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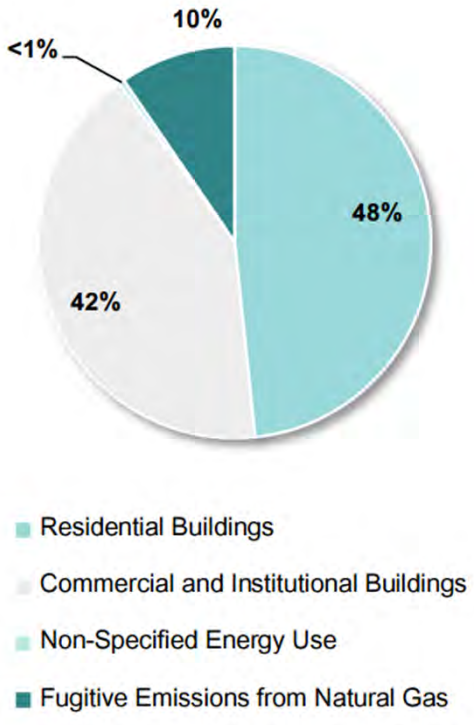

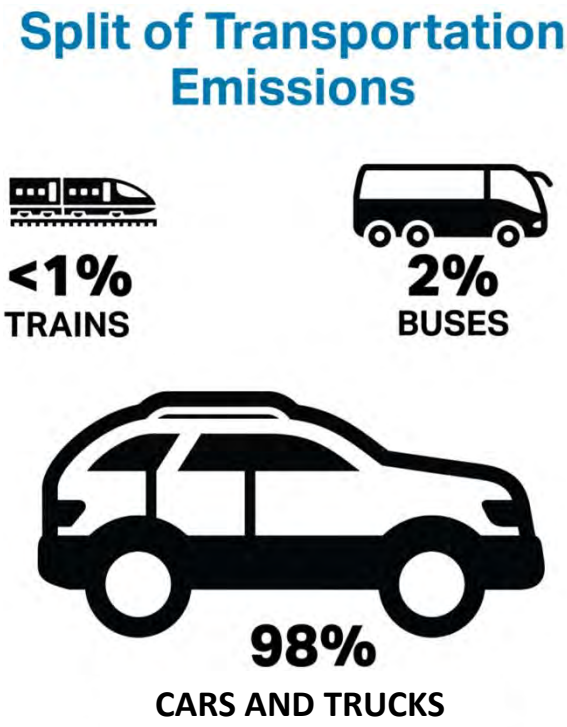

Community Emissions: Stationary energy and transportation

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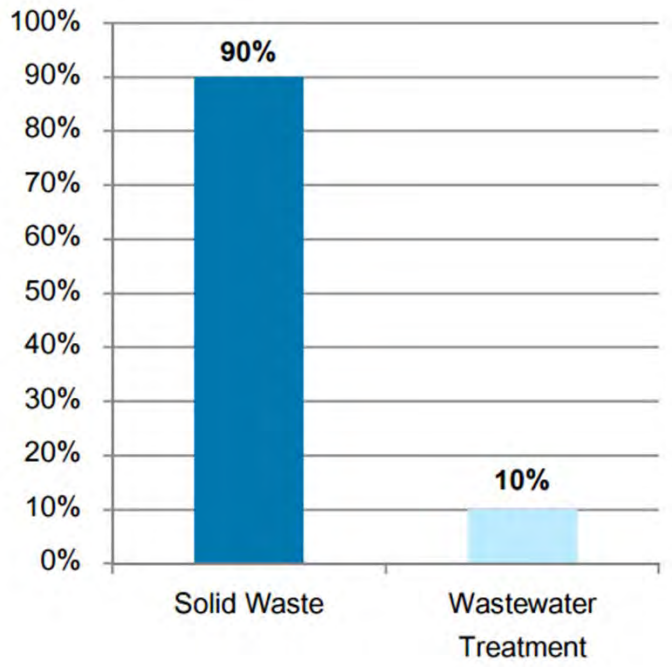
Solid waste emissions

Solid Waste

- Combustion of solid waste in Saugus incinerator
- Mainly non-recycled plastic component of waste stream

Wastewater

- Methane and Nitrous Oxide (fugitive) emissions from Deer Island treatment plant



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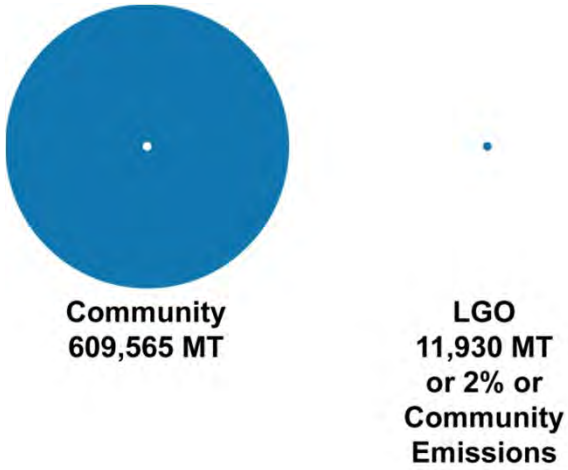
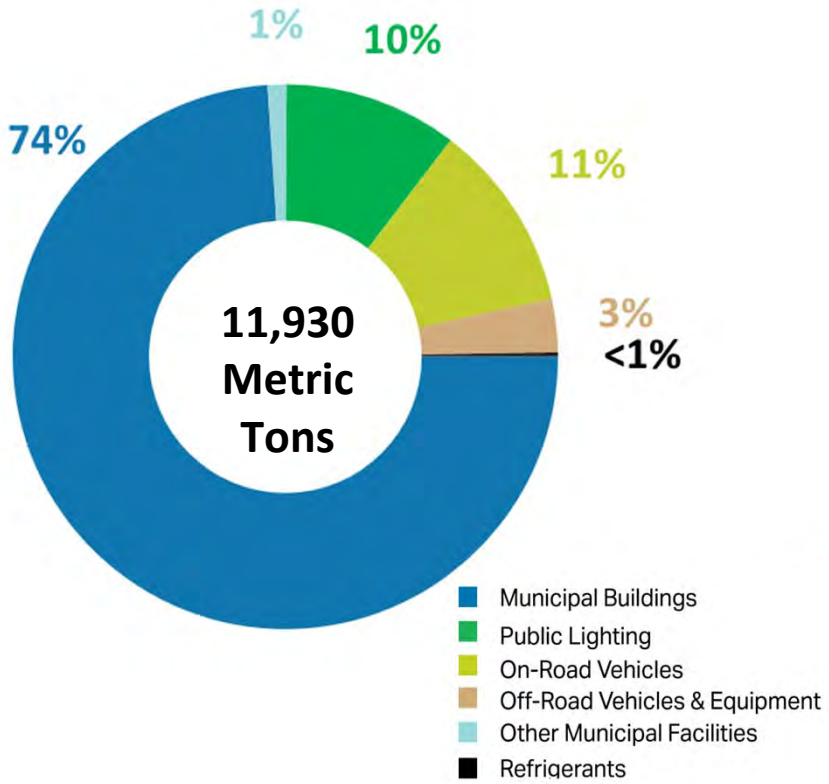
Local government emissions

Municipal emissions are small but important!





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Municipal emissions by use

65% SCHOOLS

14% ADMINISTRATION

10% RECRATION

10% EMERGENCY SERVICES

2% LIBRARIES

*Values do not total 100% due to rounding

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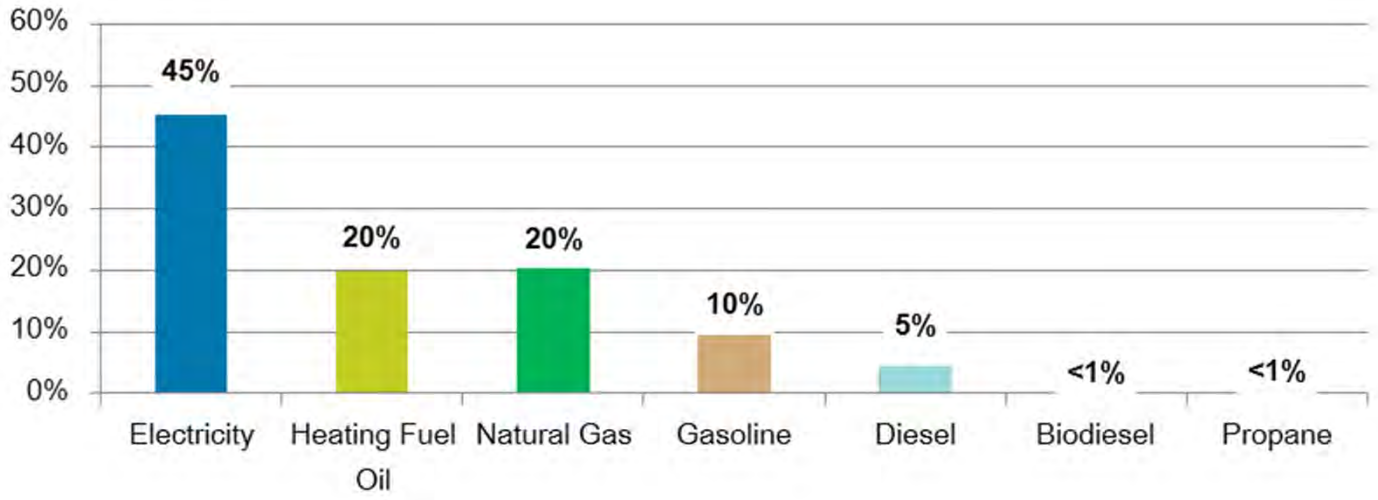

Municipal emissions by fuel type

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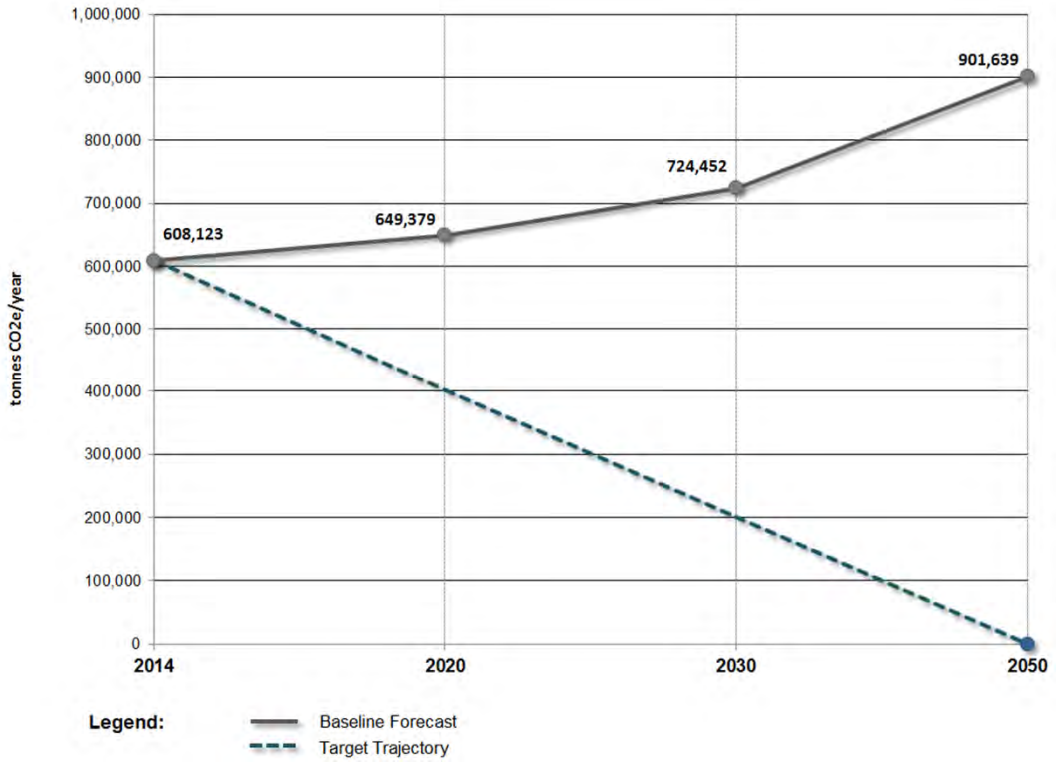
Carbon neutrality pathway analysis

- A scenario that demonstrates the technological transformations necessary to achieve a target level of emissions.
- Developed using the Somerville 2014 community GHG emissions inventory and city context-specific calculations made in the Compact of Mayors / C40 Cities Climate Action for Urban Sustainability (CURB) tool
- Hypothetical and aggressive (but feasible) application of technologies and practices
- What it's not:
  - The plan, the only possible scenario, policy implementation

Credit: Jonas Kahn

Somerville's Carbon neutrality target



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Emissions levels on reductions pathway

Year	Emissions MT CO_2e/Year	Population	Pathway Emissions per Capita	Science-Based Target Emissions per Capita
2014 (Base Year)	608,123	78,900	7.7	NA
2020 (Reduction Pathway)	391,127	84,253	4.6	TBD
2030 (Reduction Pathway)	206,110	93,993	2.2	2.9
2050 (Reduction Pathway)	48,686	116,982	0.4	0.0

- The proposed reduction pathway shows the transitions that are likely necessary to realize these levels of emissions.
- Strong early action will be needed to achieve the 2030 levels
- Some offsets will be required to achieve the 2050 net zero carbon emissions target.

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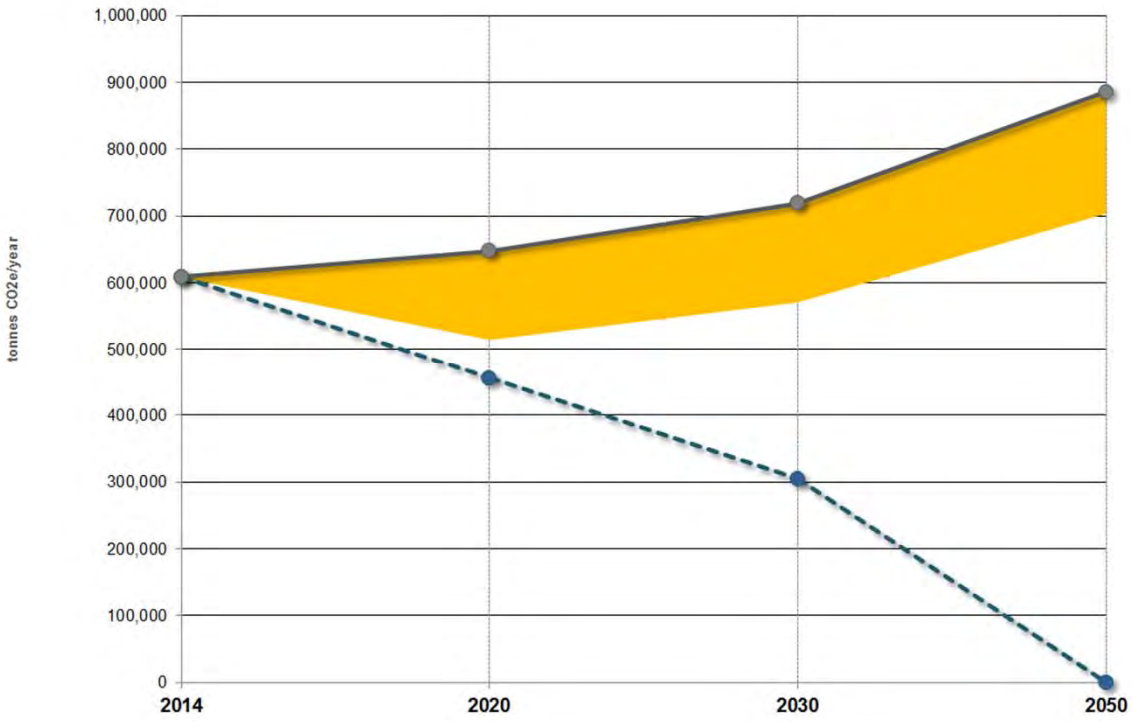
Electricity

Image Source: Hal Morgan



2020

- Reduction = 98,000 MT C02e
- 80% renewable

2030

- Reduction = 167,000 MT C02e
- 100% renewable

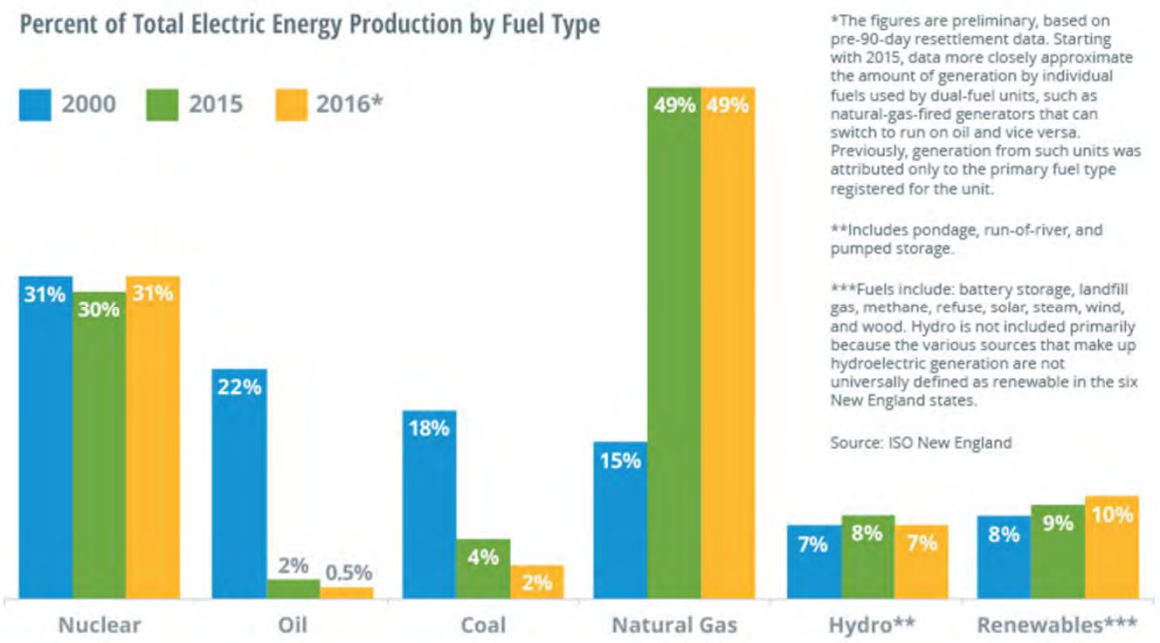
2050

- Reduction = 248,000 MT C02e
- 100% renewable

Lower carbon electricity

Electricity generation

What fuels are used to make our electricity?



Source: ISO New England

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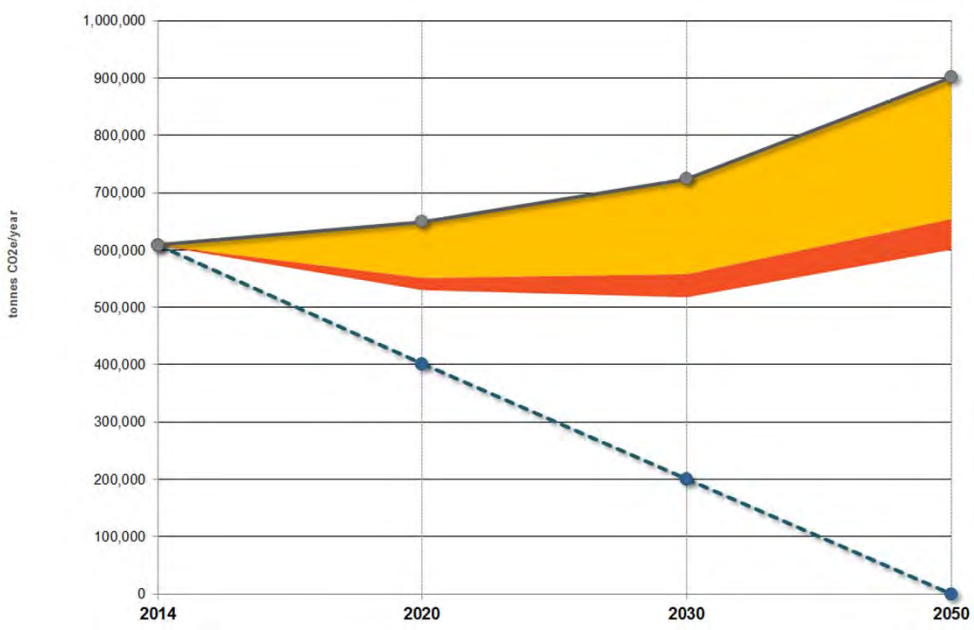
Buildings

Image Source: Eric Kilby



2020

- Reduction = 24,000 MT C02e
- 15% advanced insulation & windows
- 50% low-flow water fixtures
- 15% of LED lights & energy star appliances
- 15% high efficiency chillers

2030

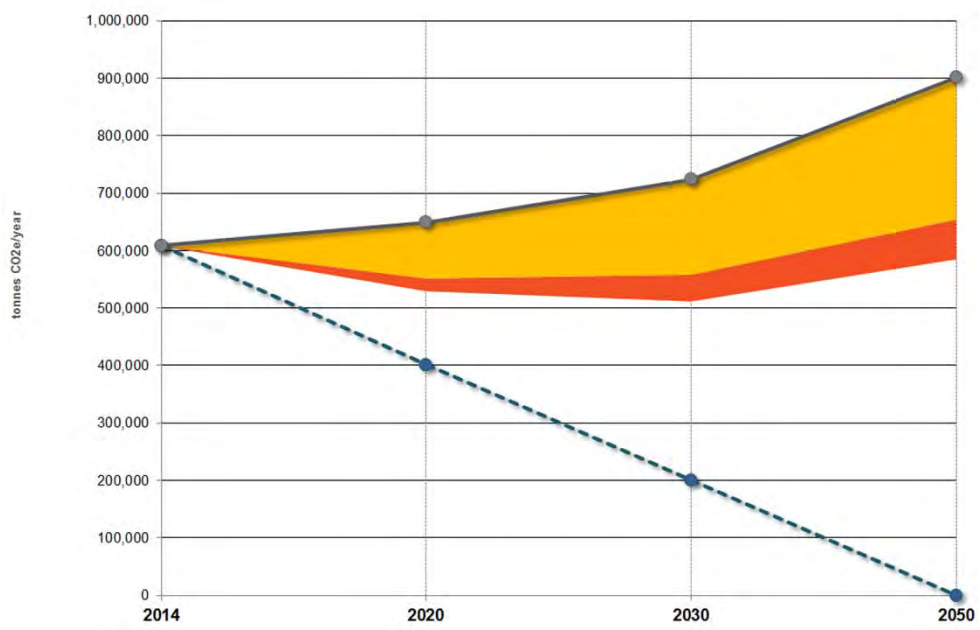
- Reduction = 56,000 MT C02e
- 50% advanced insulation & windows
- 100% low-flow water fixtures
- 50% of LED lights & energy star appliances
- 50% high efficiency chillers

2050

- Reduction = 58,000 MT C02e
- 100 % advanced insulation & windows
- 100% low-flow water fixtures
- 100% of LED lights & energy star appliance
- 100 % high efficiency chillers

Existing Residential and Commercial - Energy Efficiency

Building Energy



2020

- Reduction = 2,000 MT C02e
- 100% low-flow water fixtures
- 100 % advanced insulation & windows
- 100% of LED lights & energy star appliance
- 100 % high efficiency chillers

2030

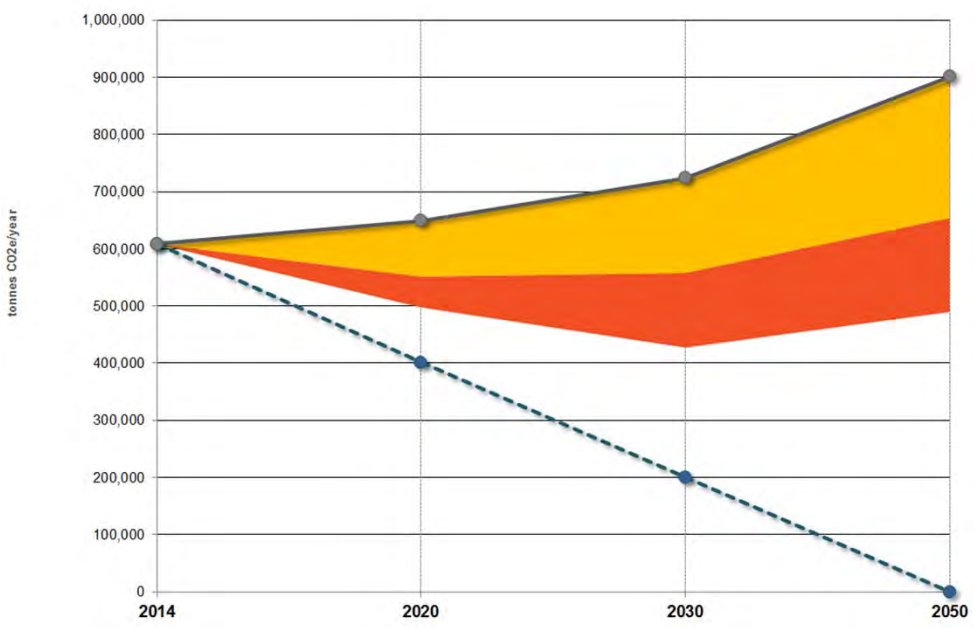
- Reduction = 15,000 MT C02e
- 100% low-flow water fixtures
- 100 % advanced insulation & windows
- 100% of LED lights & energy star appliance
- 100 % high efficiency chillers

2050

- Reduction = 25,000 MT C02e
- 100% low-flow water fixtures
- 100 % advanced insulation & windows
- 100% of LED lights & energy star appliance
- 100 % high efficiency chillers

New Residential and Commercial - Energy Efficiency

Building Energy



2020

- Reduction = 17,000 MT C02e
- 10% switch to air source heat pump & electric for space heating & hot water in existing buildings
- 60% air source heat pump and electric for space heating & hot water in new buildings

2030

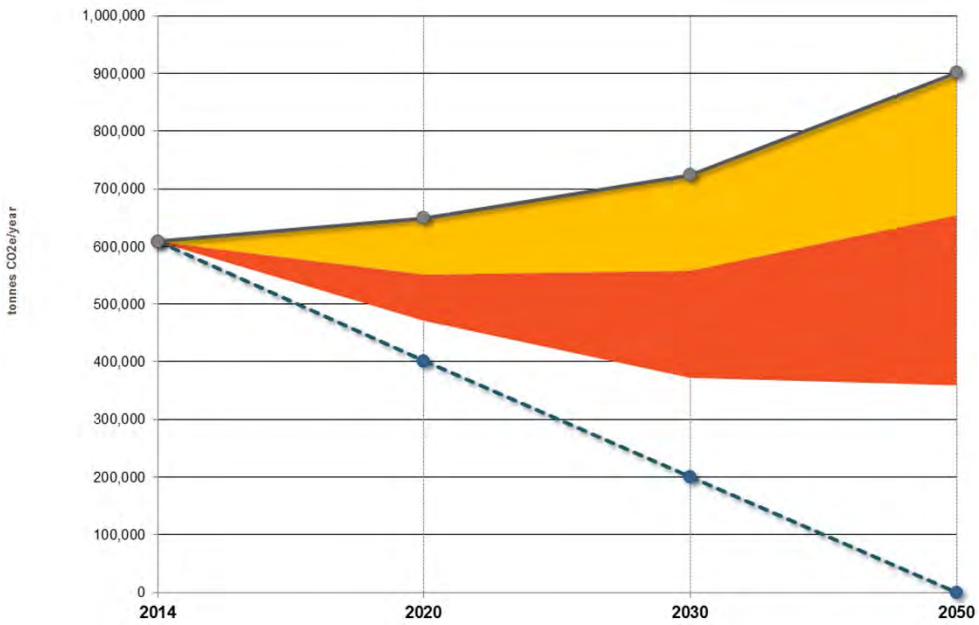
- Reduction = 54,000 MT C02e
- 50% switch to air source heat pump & electric for space heating & hot water
- 60% air source heat pump & electric for space heating & hot water in new buildings

2050

- Reduction = 68,000 MT C02e
- 60% switch to air source heat pump and electric for space heating and hot water

Existing & New - Residential & Commercial - Fuel Switch

Building Energy



2020

- Reduction = 25,000 MT C02e
- 10% adoption
- District heat and cooling
- Biomass fuel

2030

- Reduction = 53,000 MT C02e
- 20% adoption
- District heat and cooling
- Biomass fuel

2050

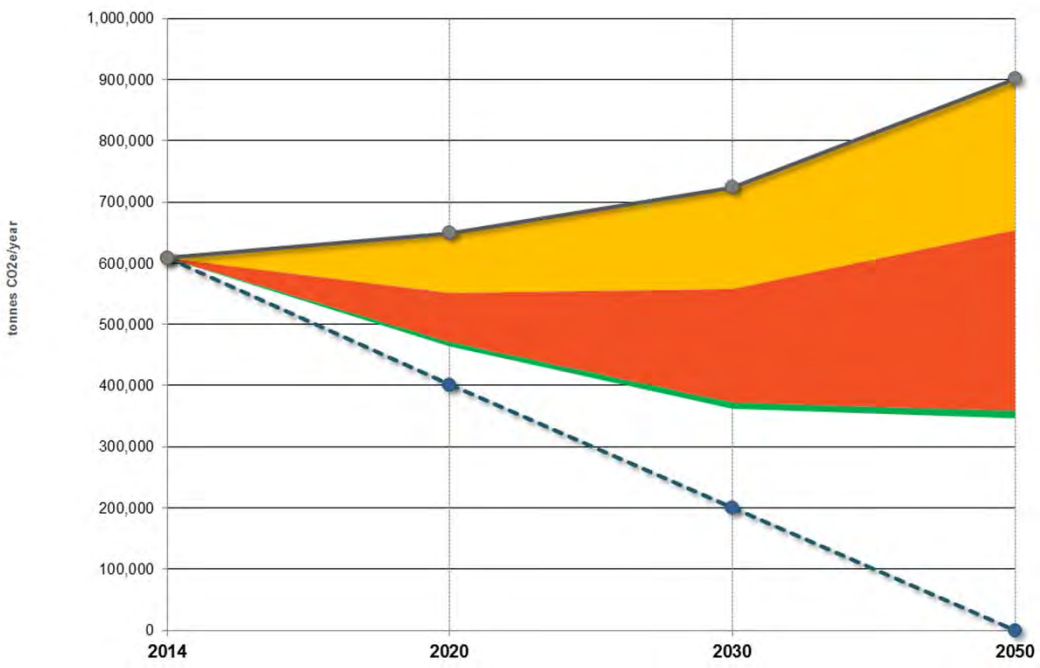
- Reduction = 109,000 MT C02e
- 40% adoption
- District heat and cooling
- Biomass fuel

Existing & New - Commercial & Residential - District Energy (biomass combined heat and power)

Building Energy

Waste

Image Source: Brad Kelly Photo



2020

- Reduction = 7,000 MT C02e
- 90% plastic diversion
- 70% paper diversion

2030

- Reduction = 10,000 MT C02e
- 100% plastic diversion
- 80% paper diversion

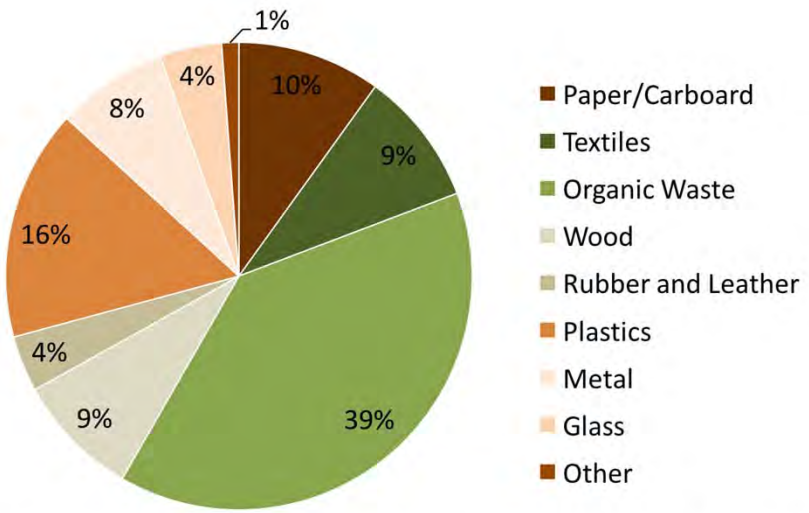
2050

- Reduction = 13,000 MT C02e
- 100% plastic diversion
- 80% paper diversion

Solid Waste - Plastics and Paper Diversion

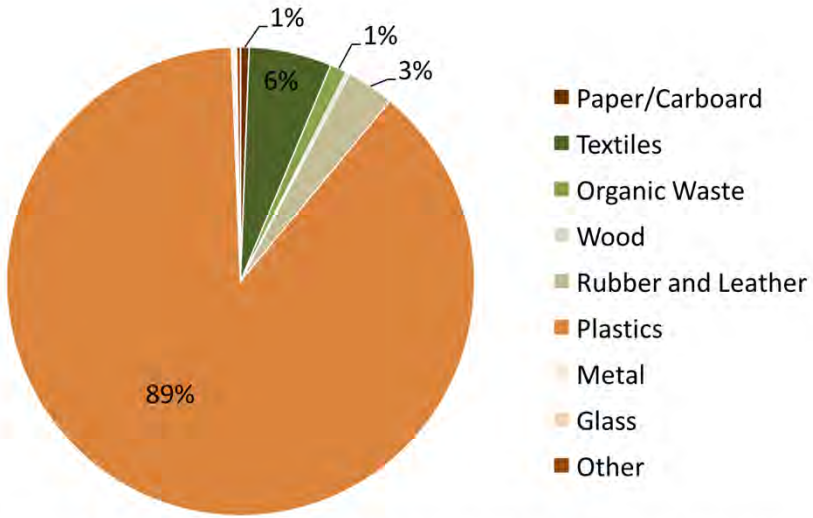
Waste

Waste by Weight



Source: *Advancing Sustainable Materials Management: 2014 Fact Sheet*, US Environmental Protection Agency, November 2016

Waste by Emissions

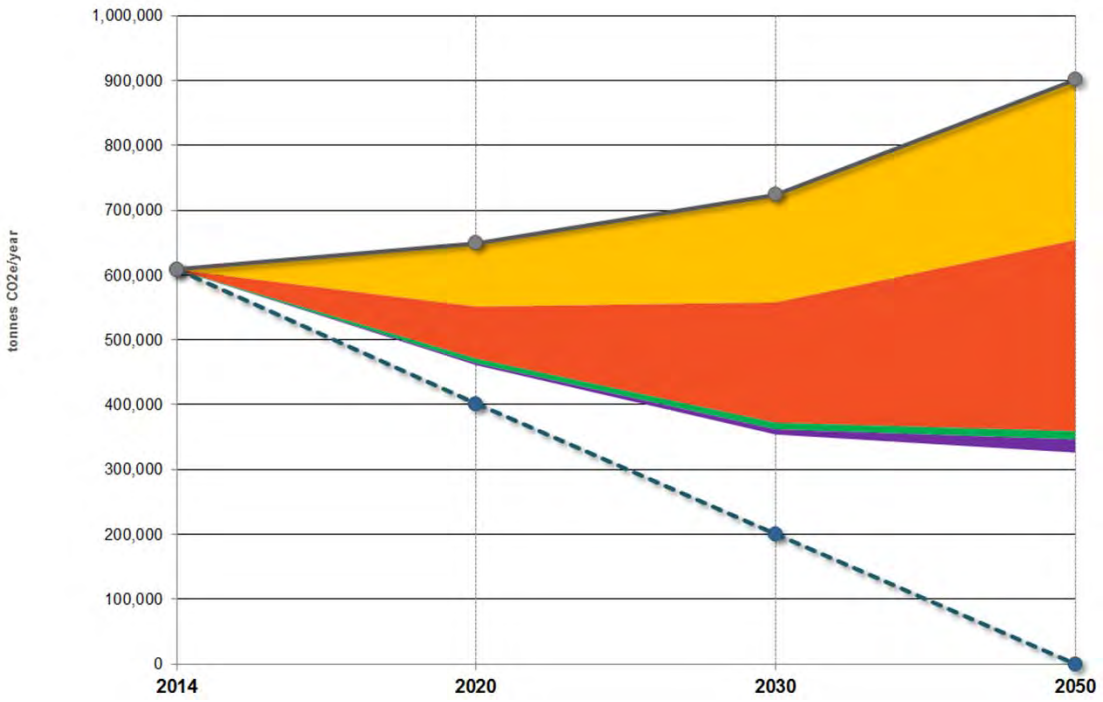


*Wood, Rubber and Leather, Metal and Glass each contributed less than 1% to total emissions from waste incineration.

2016 Solid Waste Data

Transportation

Image Source: Eric Kilby



2020

- Reduction = 3,000 MT C02e
- 100% of new development in TOD
- 25% reduction of VMT generation in TODs

2030

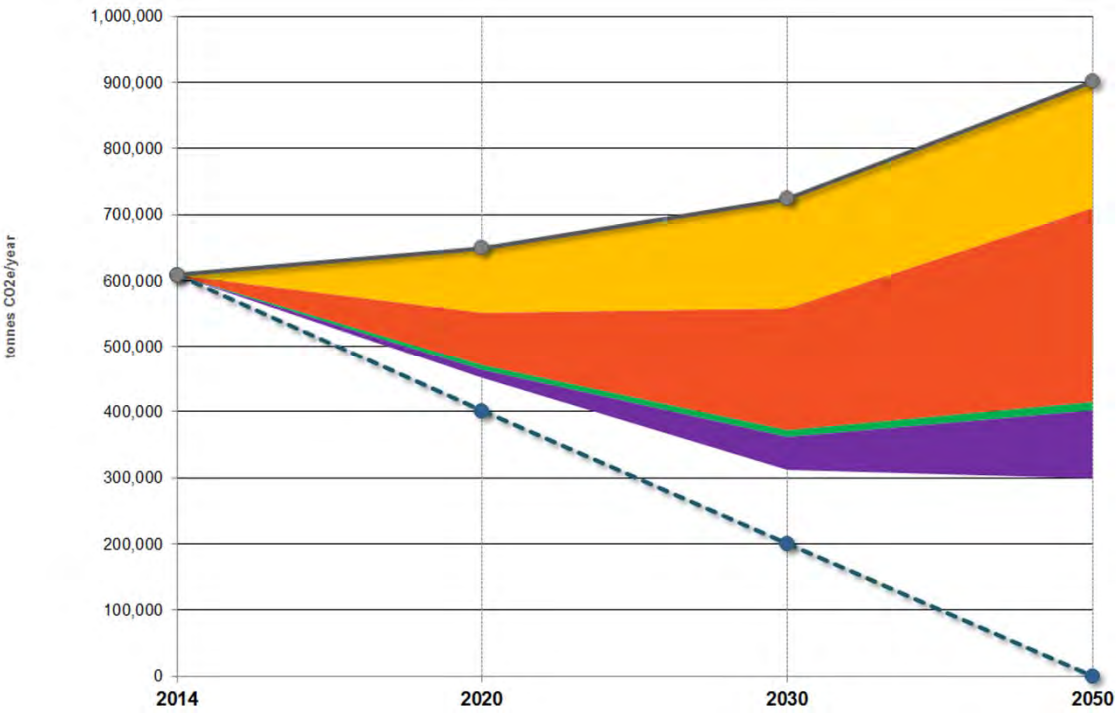
- Reduction = 8,000 MT C02e
- 100% of new development in TOD
- 25% reduction of VMT generation in TODs

2050

- Reduction = 20,000 MT C02e
- 100% of new development in TOD
- 25% reduction of VMT generation in TODs

Transit oriented development and mixed-use

Transportation



2020

- Reduction = 8,000 MT C02e
- 5% shift from SOV to subway
- 1% shift from SOV to walk/bike

2030

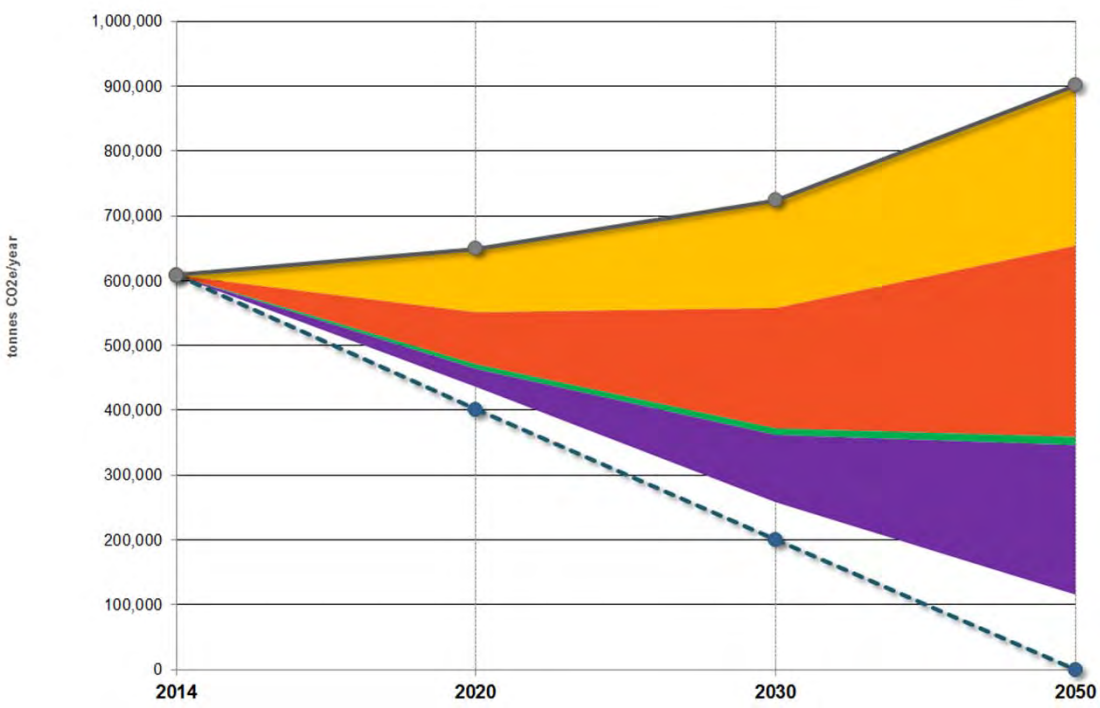
- Reduction = 42,000 MT C02e
- 20% shift from SOV to subway
- 5% shift from SOV to walk/bike

2050

- Reduction = 54,000 MT C02e
- 30% shift from SOV to subway
- 8% shift from SOV to walk/bike

Mode shift

Transportation



2020

- Reduction = 16,000 MT C02e
- 10% passenger vehicles to electric

2030

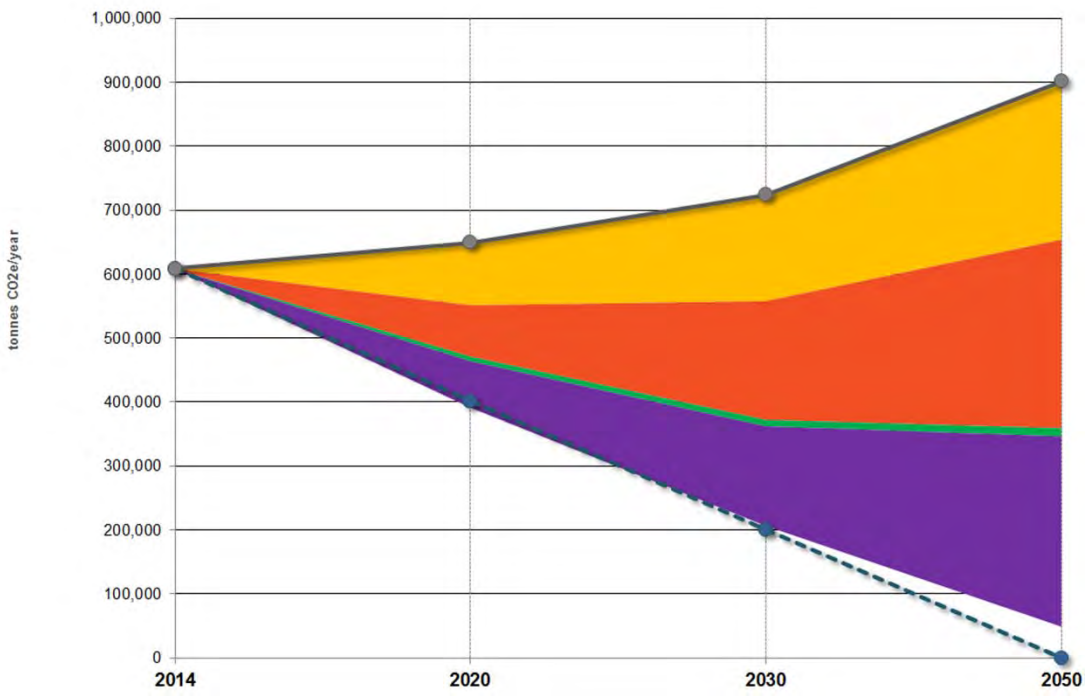
- Reduction = 56,000 MT C02e
- 40% passenger vehicles to electric

2050

- Reduction = 161,000 MT C02e
- 100% passenger vehicles to electric

Passenger vehicle fuel switch

Transportation



2020

- Reduction = 33,000 MT C02e
- 100% trucks and off-road vehicles to biodiesel

2030

- Reduction = 42,000 MT C02e
- 100% trucks and off-road vehicles to biodiesel

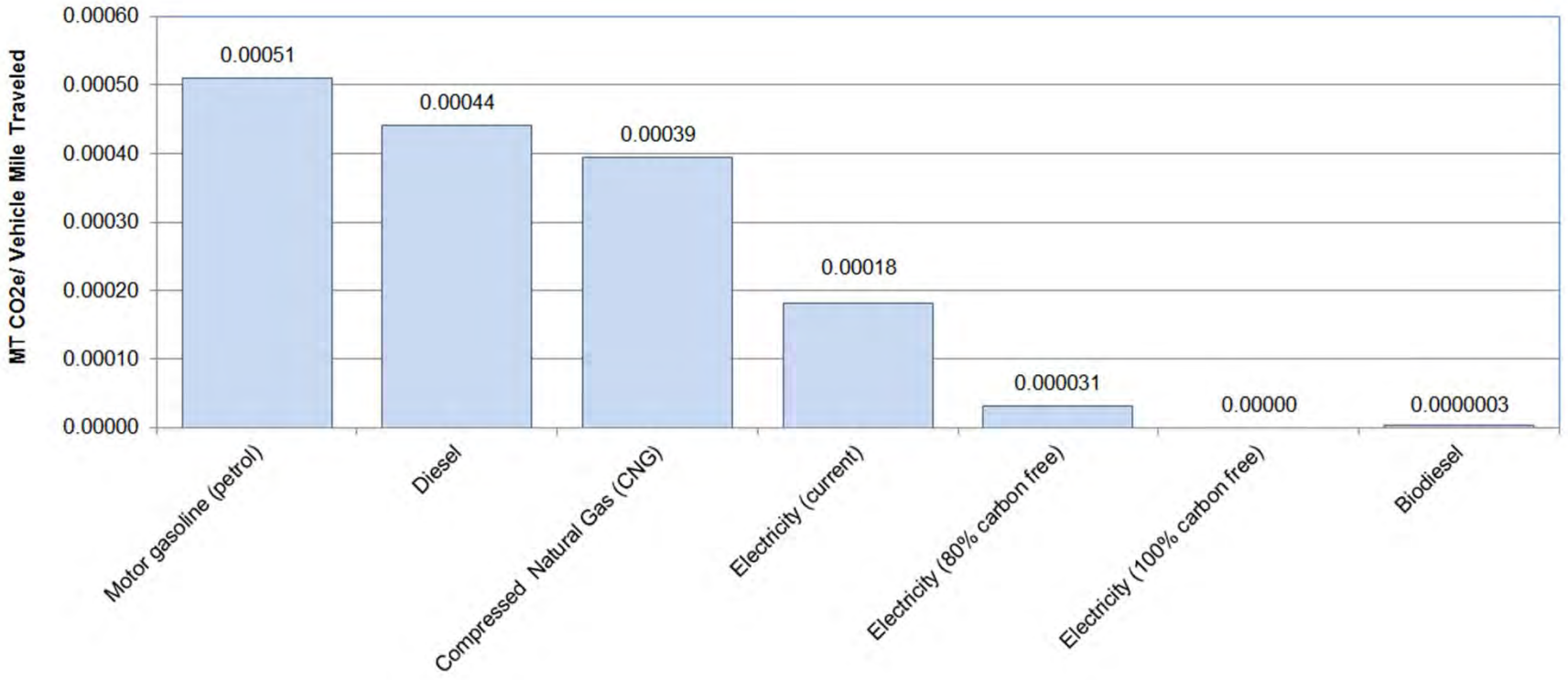
2050

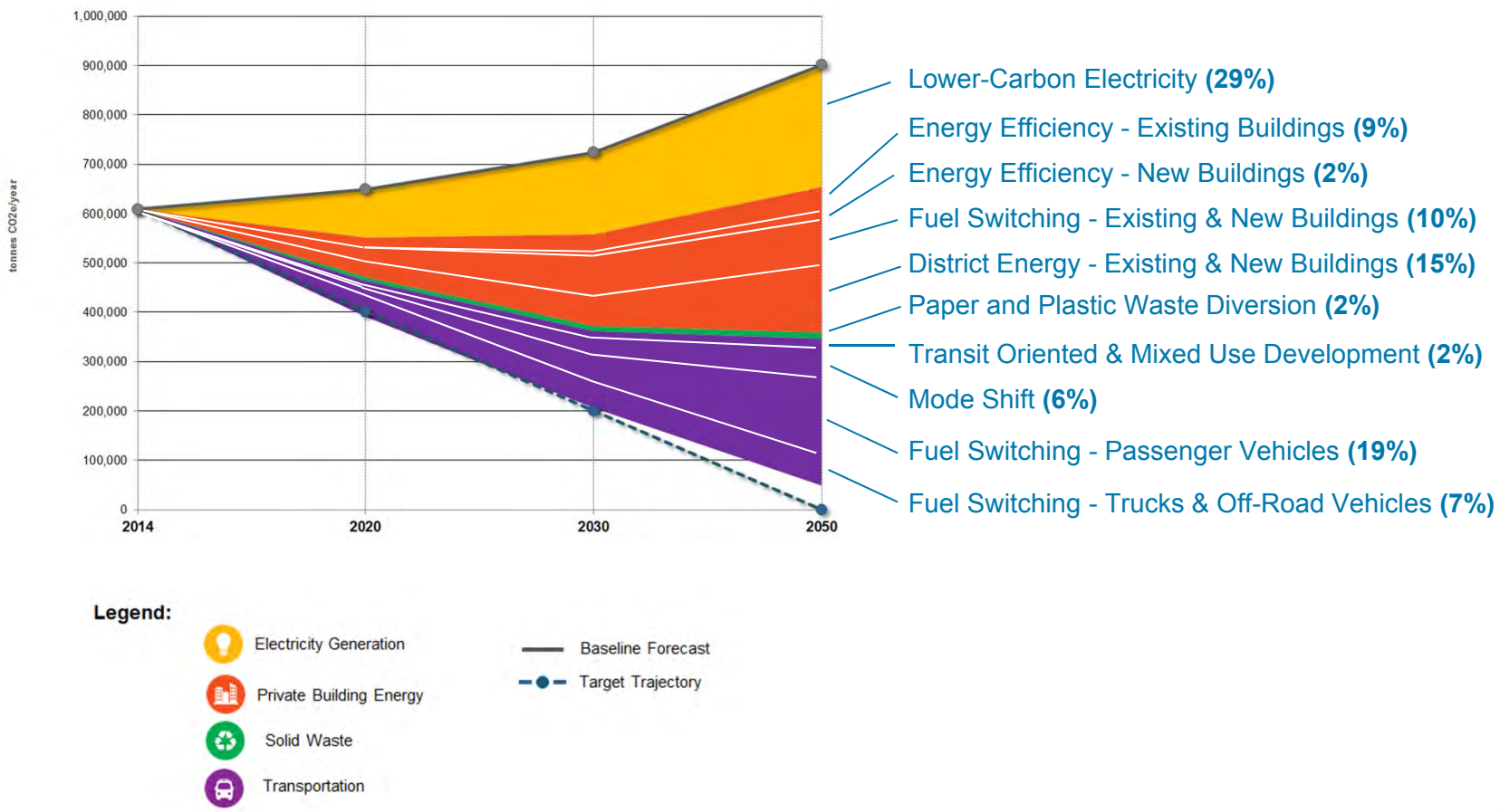
- Reduction = 62,000 MT C02e
- 100% trucks and off-road vehicles to biodiesel

Truck and off-road vehicle fuel switch

Transportation

Emissions from vehicle fuel types





Carbon neutrality pathway core strategies

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Carbon reduction core strategies

Strategy	Emissions Reduction Potential (MT CO_2e/Year)			% of 2050 reductions
	2020	2030	2050	
★ Lower-Carbon Electricity (CCA & RPS)	98,000	167,000	248,000	**29%**
★ Building Energy Efficiency	23,000	49,000	77,000	**9%**
★ Building Energy Fuel Switching	31,000	81,000	88,400	**10%**
★ District Energy	26,000	55,000	131,000	**15%**
Paper and Plastic Waste Diversion	7,000	10,000	13,000	2%
Transit Oriented/Mixed Use Development	3,000	8,000	20,000	2%
Passenger Mode Shift (from SOV to transit and walk/bike)	8,000	42,000	54,000	6%
★ Vehicle Fuel Switching (passenger - fossil fuels to electric)	16,000	56,000	161,000	**19%**
Vehicle Fuel Switching (trucks - diesel to biodiesel)	30,000	34,000	42,000	5%
Vehicle Fuel Switching (off-road - diesel to biodiesel)	3,000	8,000	20,000	2%

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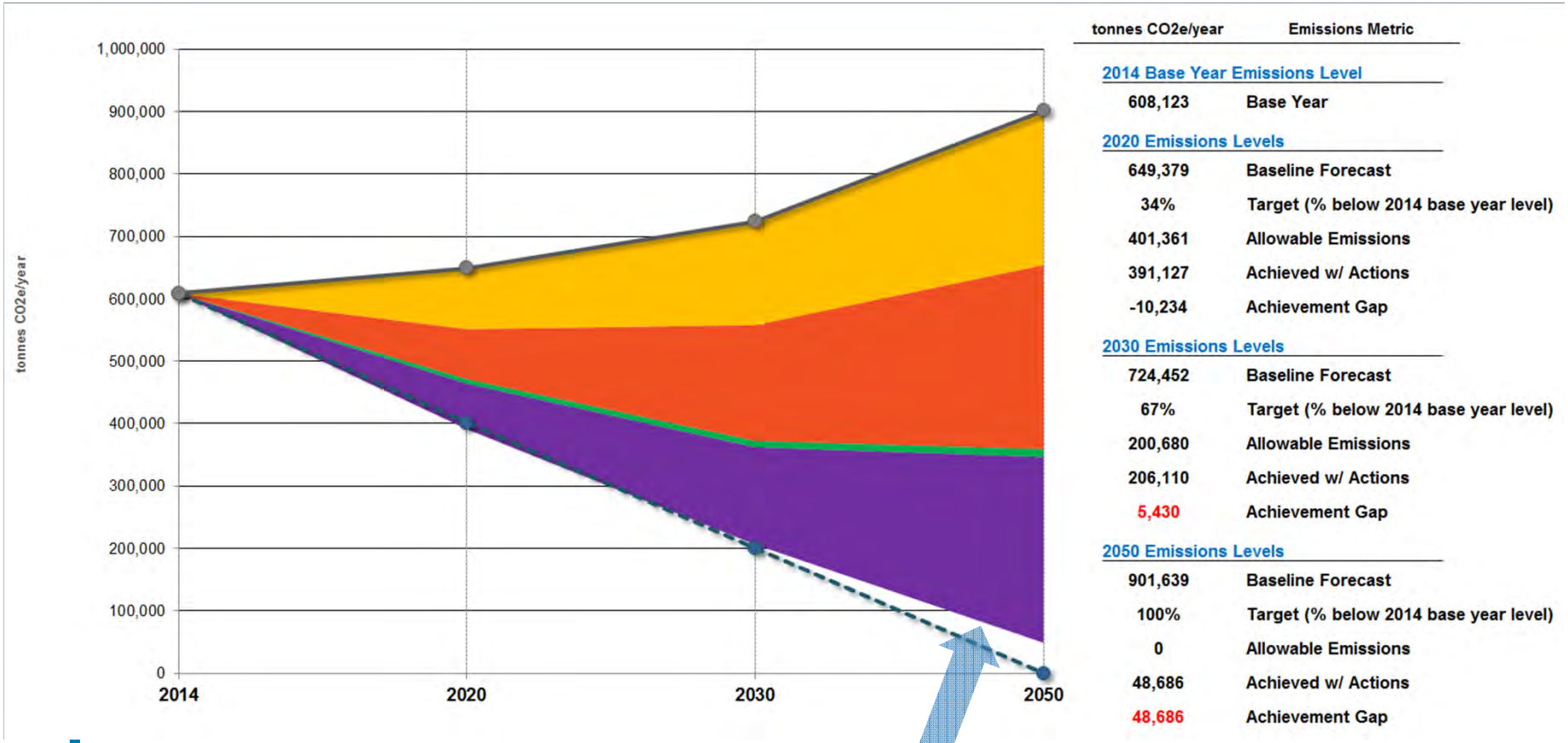
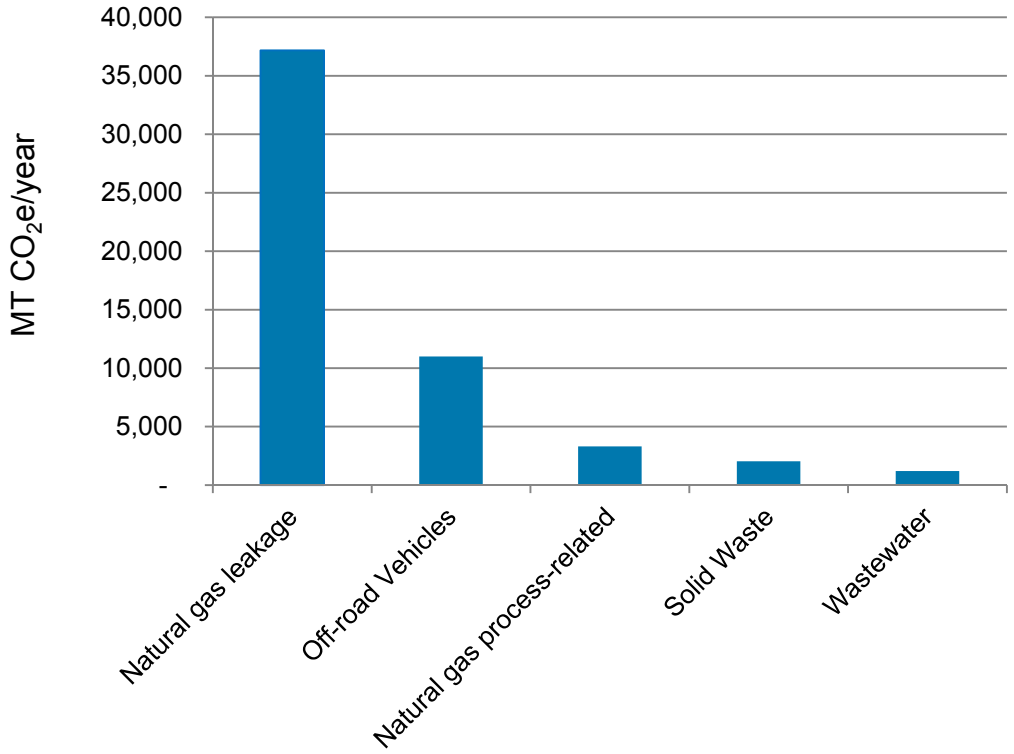


tonnes CO2e/year	Emissions Metric
2014 Base Year Emissions Level	
608,123	Base Year
2020 Emissions Levels	
649,379	Baseline Forecast
34%	Target (% below 2014 base year level)
401,361	Allowable Emissions
391,127	Achieved w/ Actions
-10,234	Achievement Gap
2030 Emissions Levels	
724,452	Baseline Forecast
67%	Target (% below 2014 base year level)
200,680	Allowable Emissions
206,110	Achieved w/ Actions
5,430	Achievement Gap
2050 Emissions Levels	
901,639	Baseline Forecast
100%	Target (% below 2014 base year level)
0	Allowable Emissions
48,686	Achieved w/ Actions
48,686	Achievement Gap

Possible reduction pathway

Remaining emissions



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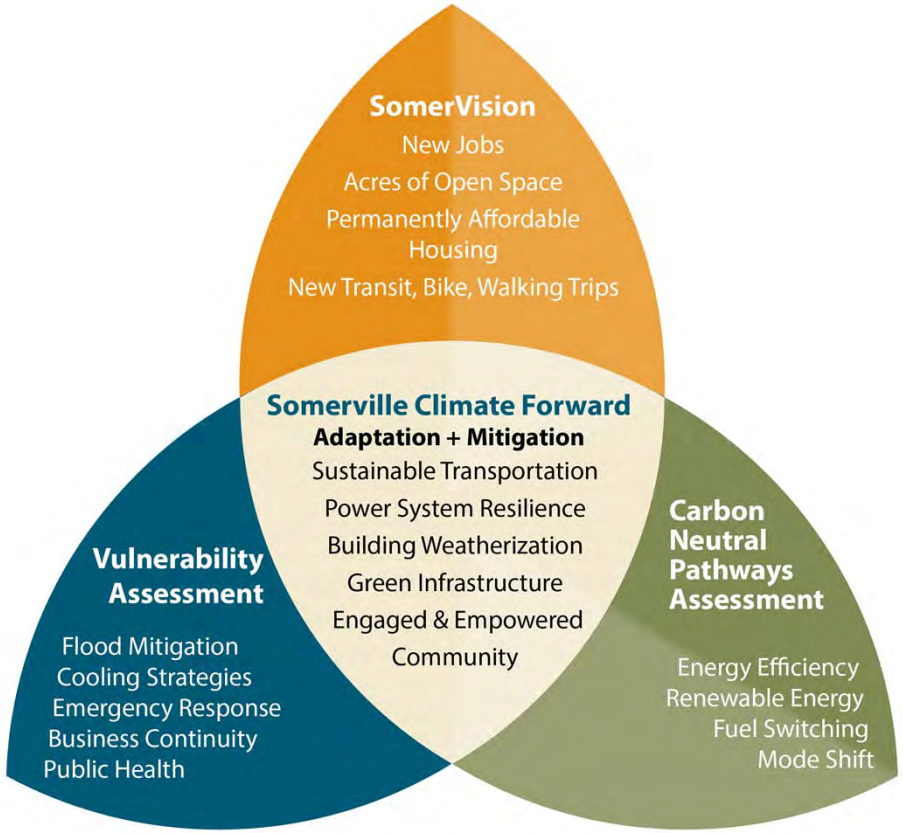
What’s next?

Somerville Climate Forward



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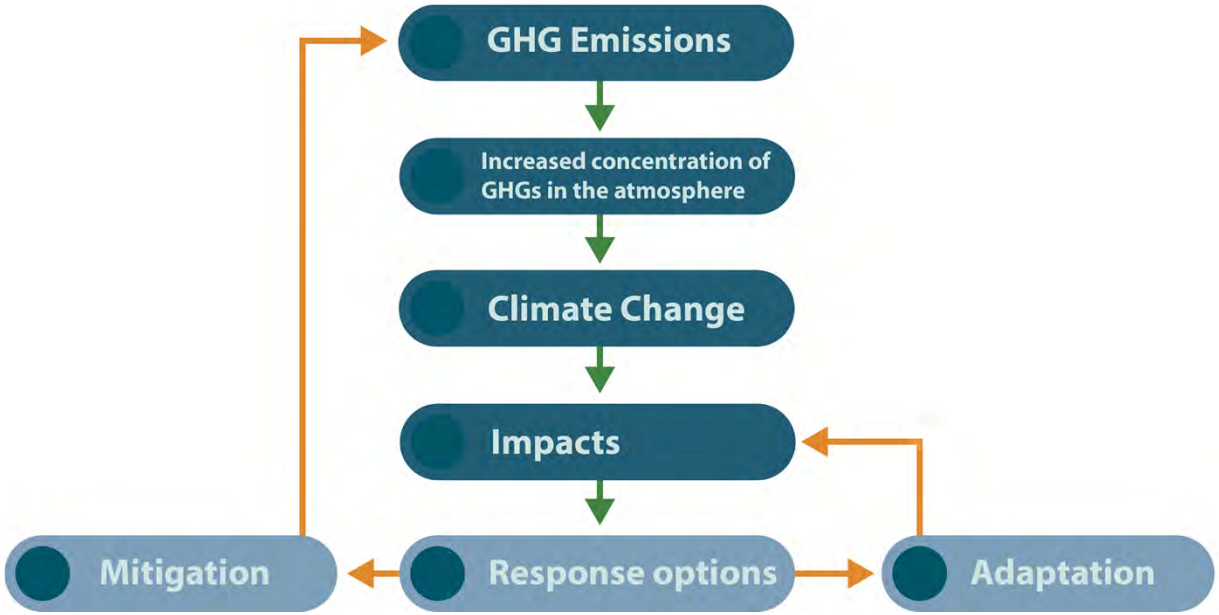
Somerville Climate Forward
Integrated approach for adaptation & mitigation



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Finding Solutions

- Somerville Climate Forward will analyze, and ultimately identify, solutions that will help achieve the necessary emissions reduction transitions.

Examples of potential solutions to reduce residential heating fuel-related emissions

Improve Building Energy Efficiency

- Property assessed clean energy financing program
- Point-of-sale energy rating ordinance
- Low-income housing weatherization program
- Green bond for community energy efficiency/fuel switch financing
- Multi-family sub-metering policy

District Energy

- Feasibility study
- New construction district heating policy

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Let’s talk!

Thank you

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Any questions?

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www.somervillema.gov/sustainaville


Photo credit: https://www.getfoundquick.com/seo-somerville-ma/

Data Collection

Local Government Operations

- Buildings and Facilities
  - *Electricity*
  - *Natural Gas*
- Public Lighting
  - *Electricity*
- Vehicle Fleet
  - *Fuel Consumption*
- Process and Fugitive Emissions
  - *Refrigerants (skating rink)*

All empirical data

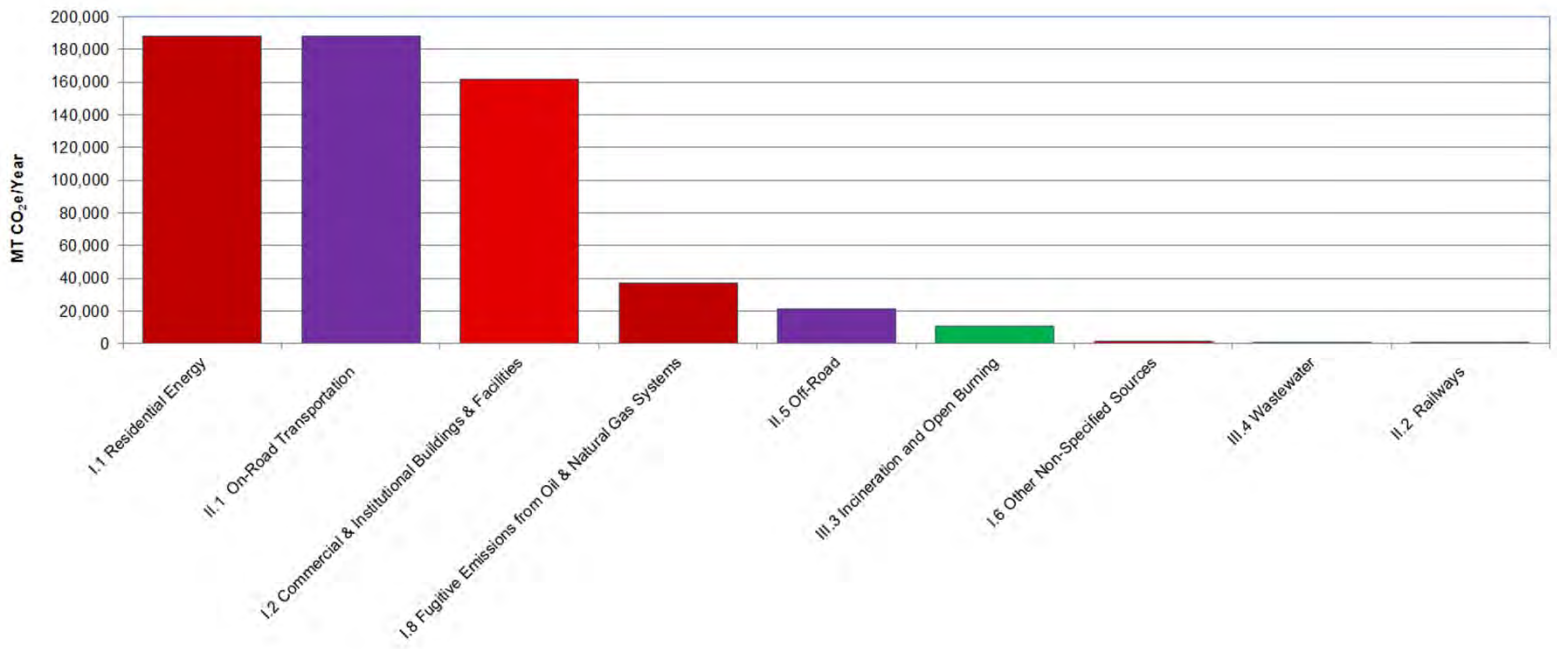
Data Collection

Community Inventory

- Stationary Energy
  - Electricity
  - Natural gas
  - Heating oil*
- Waste
  - Trash tonnage (partial model)*
  - Wastewater treatment*
- Transportation
  - On-road (passenger and truck)*
  - Off-road vehicles and equipment*
  - Public transit (buses and trains)*

***Modeled inputs**

Emissions by subsector



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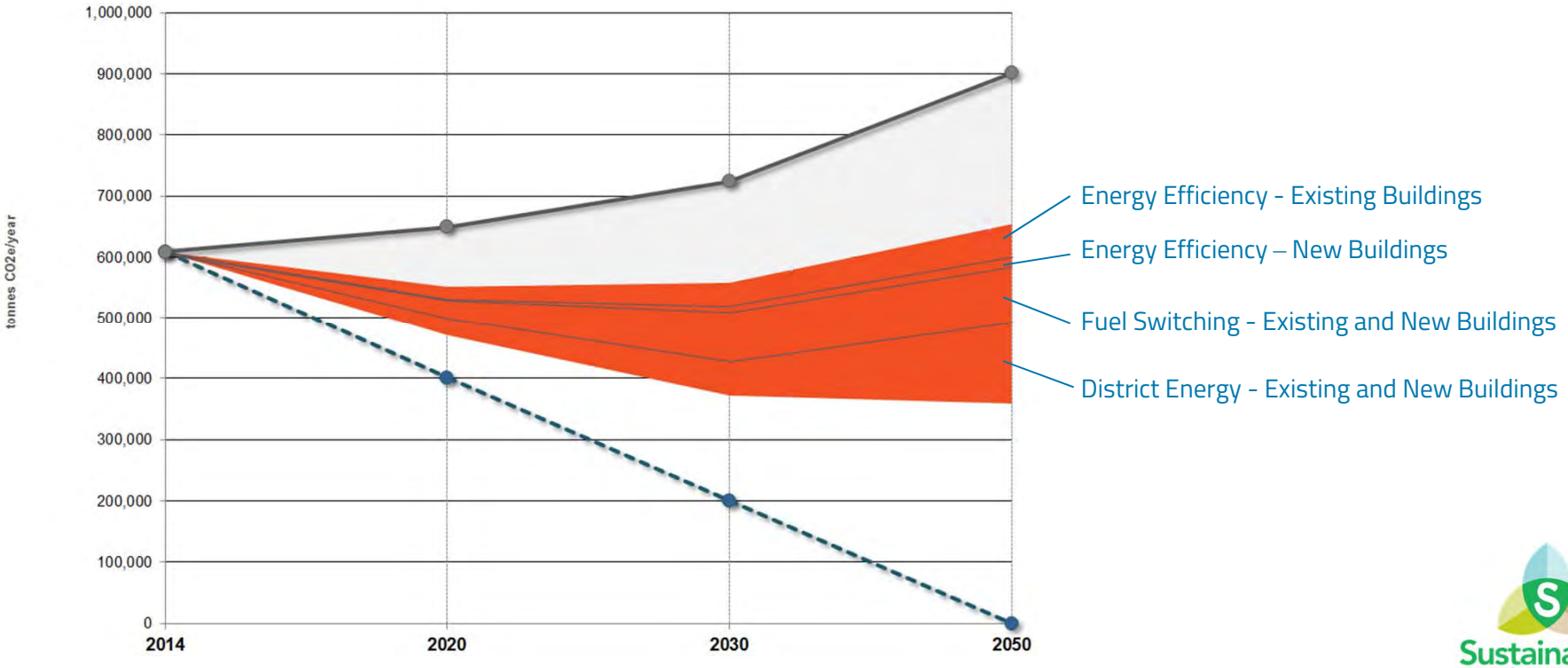
Building Energy- all strategies



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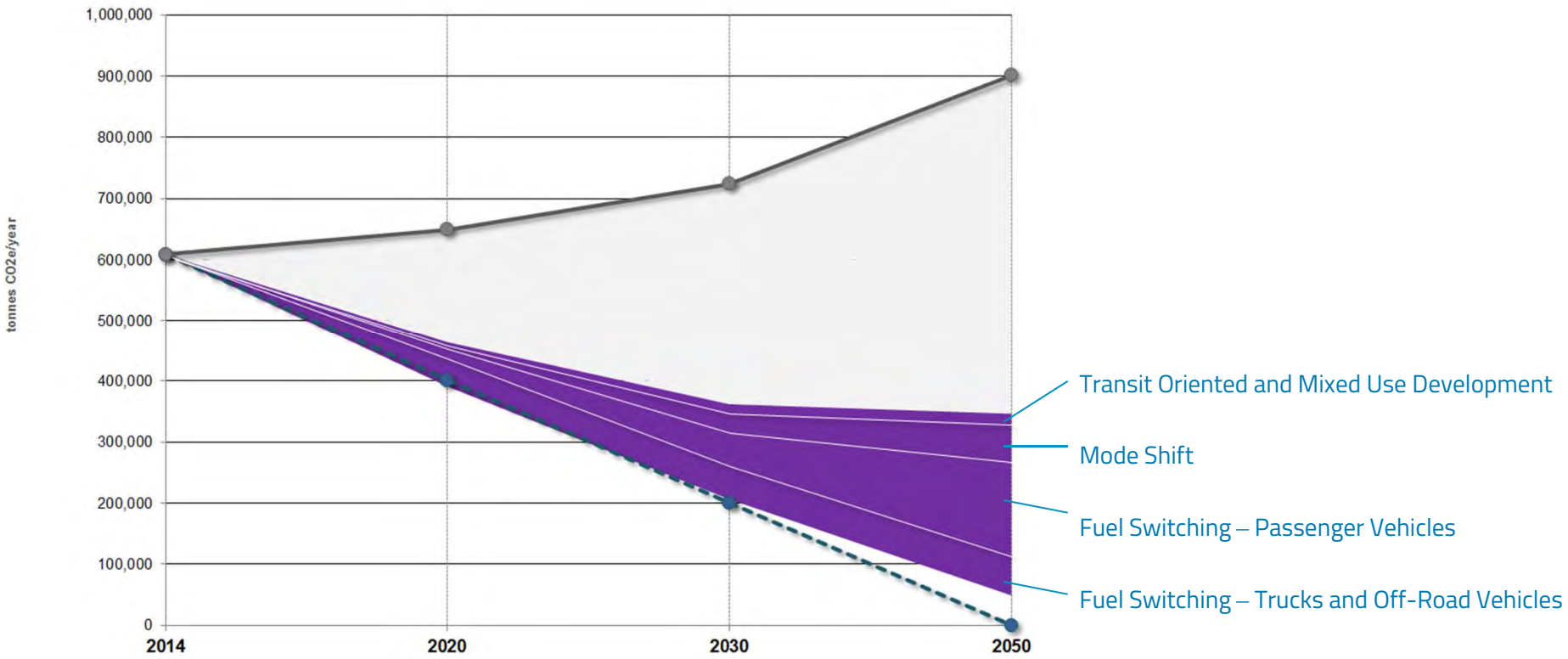

Transportation – All strategies

Credits

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
- Photographs by Unsplash

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